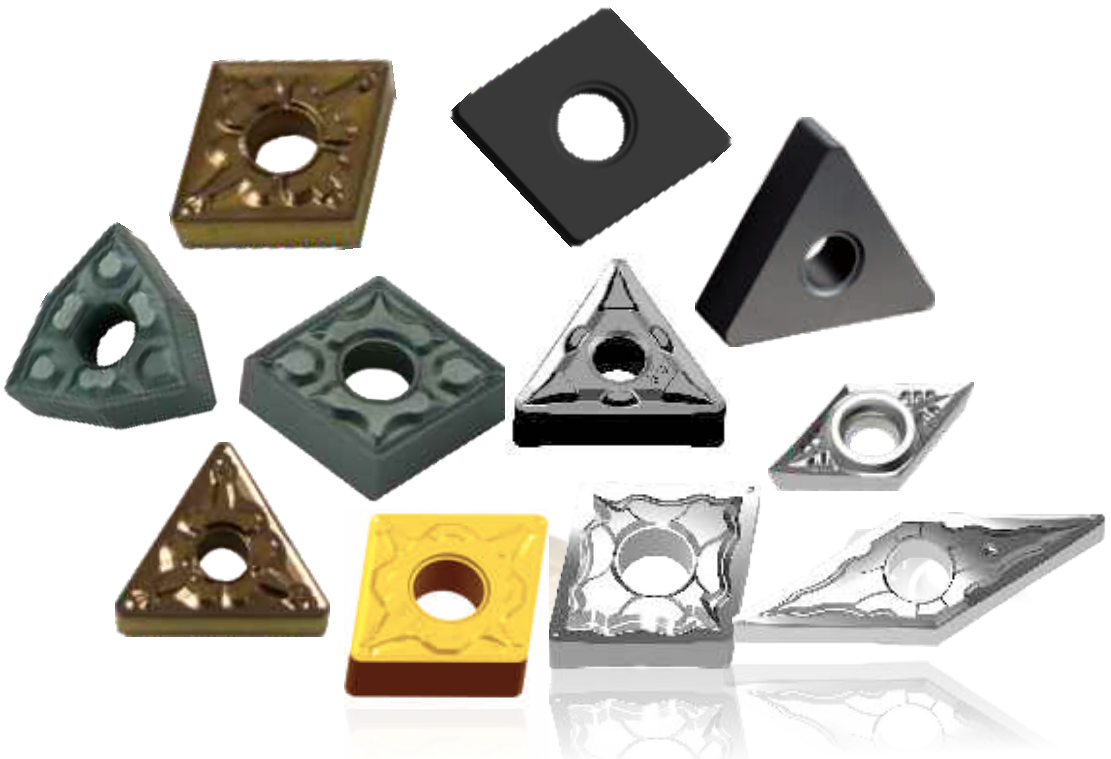
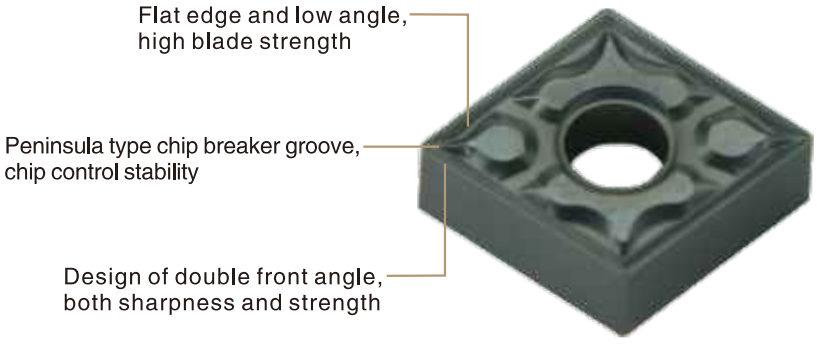
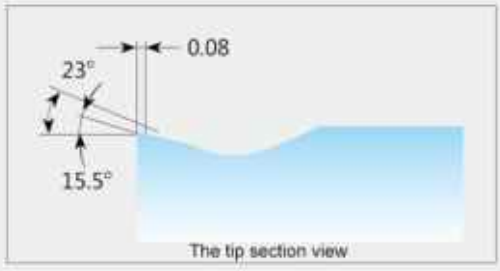
Turning Inserts

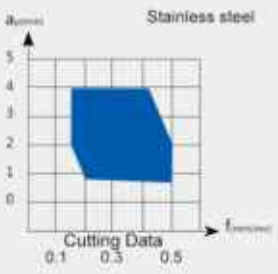


NFM Geometry case study

- The sharp cutting edge, cutting a high sharpness
- double front angle design,two–way guarantee sharpness and high strength
- full week double chip breaking groove, high versatility,is suitable for various conditions

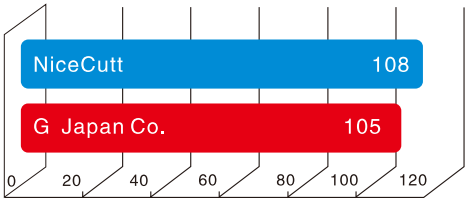




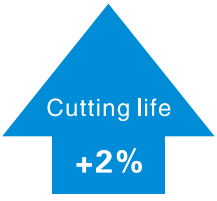


Case 1

Workpiece material	316(HB200)Stainless steel
Machining parts	The outer circle facing
Insert	TNMG160404–NFM/NS4125



The cutting parameters
Vc=106m/min
f=0.1mm/r
ap=0.5mm

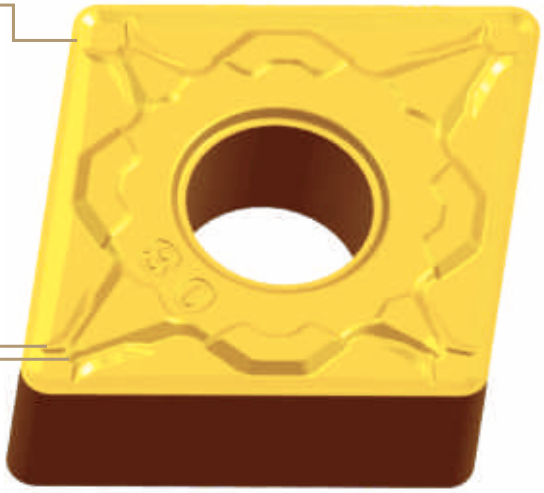


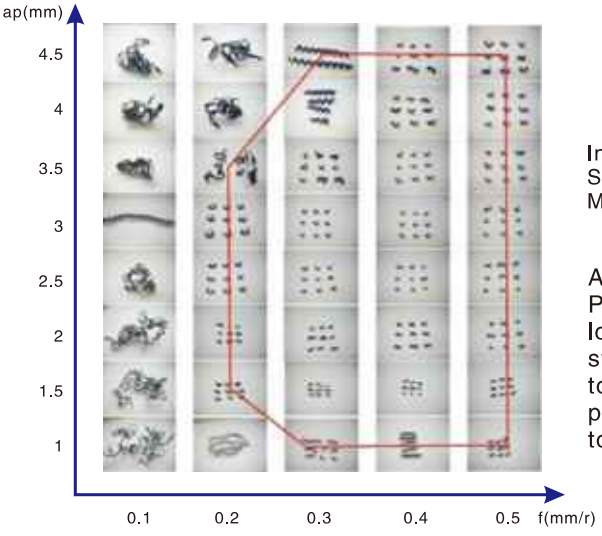
NGM Geometry case study

Variable edge width
- Good balance of sharpness and strength due to Variableland

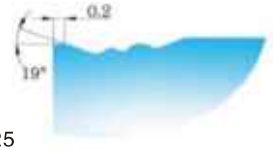
Strengthening rib
- Strengthening rib decreases the contact area between the insert surface and chips

Gradient and waved hump
- Good chip control at low depth of cut and broadened cutting region due to gradient and waved hump



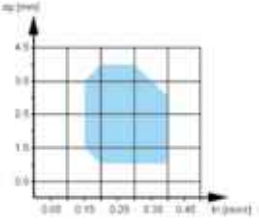


Insert: WNMG080408–NGM–NP1225
Speed:V=200M/min
Material:45# steel



Cross Section Geometry

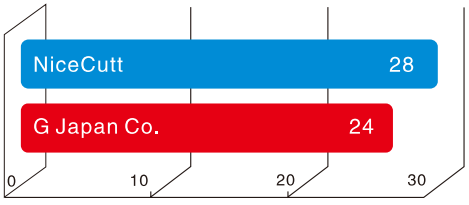
Application
Providing good chip control, low cutting force and high edge strength for medium cutting to heavy excellent cutting performance at semi–finishing to light roughing condition.



Applicable Chipbreaker

Case 1

Workpiece material	Cr15(HB160–180)
Machining parts	OD and face finishing
Insert	WNMG080408–NGM NP1225



The quantity(pieces)/tip

The cutting parameters
Vc=285m/min
f=0.2mm/r
ap=0.55mm

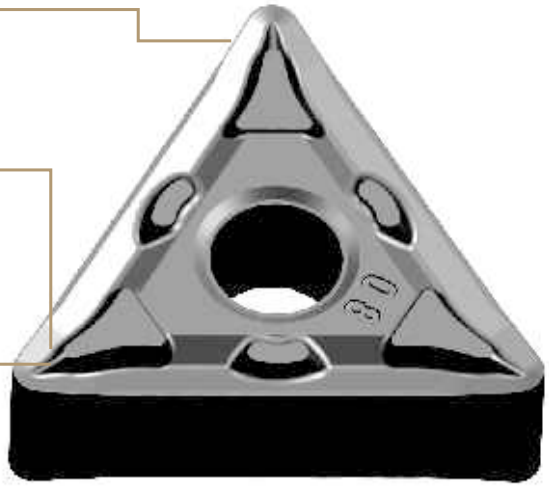
Cutting life
+17%

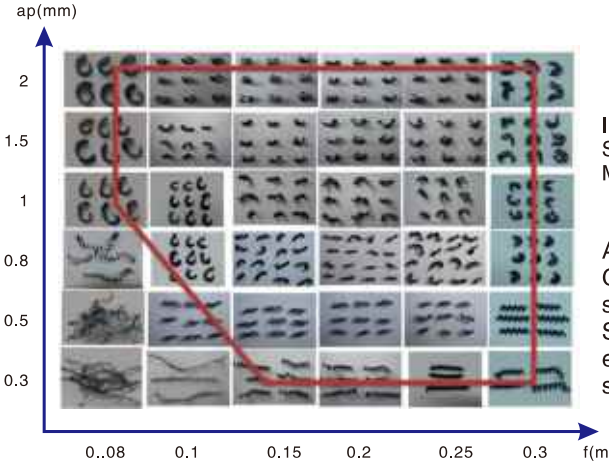
BF Geometry case study

Curved edge
・Well–balanced combination of sharpness and toughness, smooth chip discharge due to cured edge

The butterfly sharp dots at the knifepoint
・Changed chip flow and improved chip control at small depth of cut due to twin dots near corner

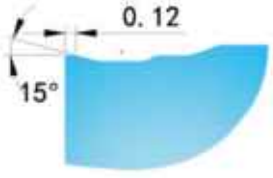
Variable Rake Angle
・Variable rake angle provides enough edge strength at difference depth of cut



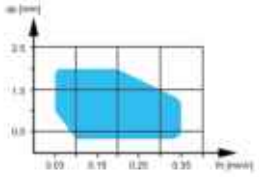


Insert: CNMG120404–BF–NS4125
Speed:V=180M/min
Material:45# steel

Application
Good chip control with an excellent surface finish at small depths of cut. Suitable for finishing of steel and excellent cutting performance at small depths of cut and low feeds.



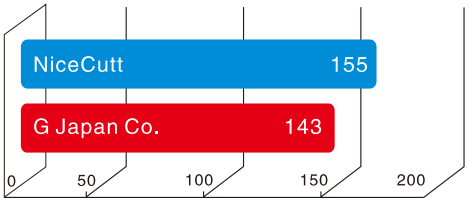
Cross Section Geometry



Applicable Chipbreaker

Case 1

Workpiece material	QCM8(HB160–200)
Machining parts	OD and face finishing
Insert	TNMG160404–BF/NS4125



The quantity(pieces)/tip

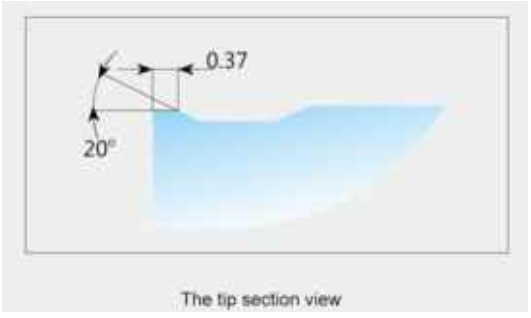
The cutting parameters
Vc=155m/min
f=0.12mm/r
ap=0.2mm

Cutting life
+9%

NK2 Geometry case study

Peculiarity

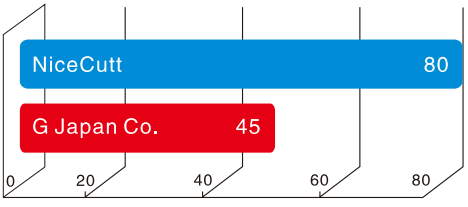
- Wide edge and groove and shallow groove depth combination,can achieve high feed processing and cutting stability
- The strength of the tool tip, in interrupted cutting and descaling cutting performance;
- In turning of cast iron, cutting resistance than flat blade small, extend tool life, the cutting performance;



The tip section view

Case 1

Workpiece material	HT250(HB190)
Machining parts	End,cylindrical semi finish turning
Insert	TNMG220412–NK2/NK1115



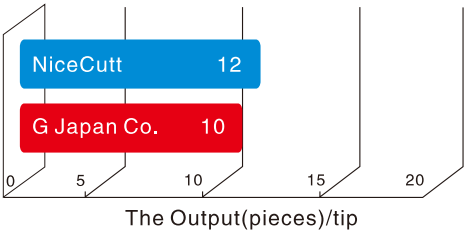
The Output(pieces)/tip

The cutting parameters
Vc=510m/min
f=0.3mm/r
ap=1mm

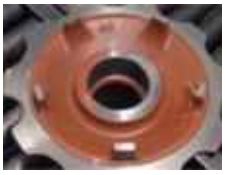
Cutting life
+78%

Case 2

Workpiece material	QT450–10(HB200)
Machining parts	The outer circle surface finishing,intermittent
Insert	WNMG080412–NK2/NK1125



The Output(pieces)/tip



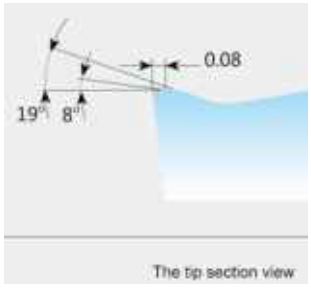
The cutting parameters
Vc=293m/min
f=0.18mm/r
ap=1.5mm

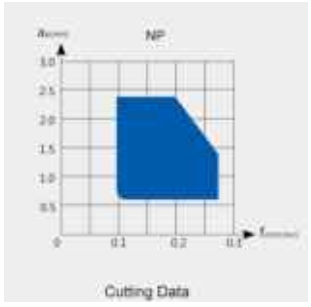
Cutting life
+20%

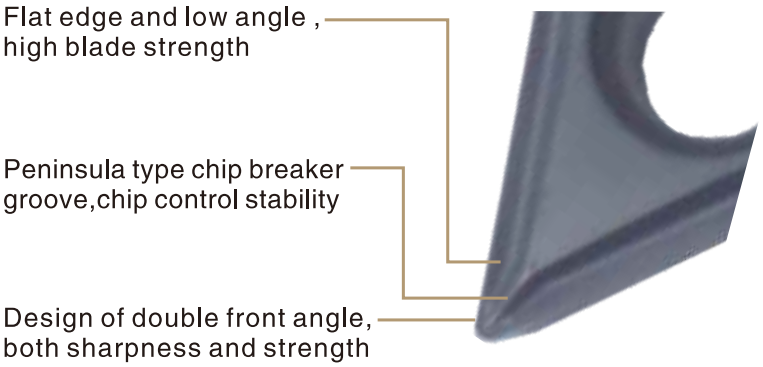
NF Geometry case study

Peculiarity

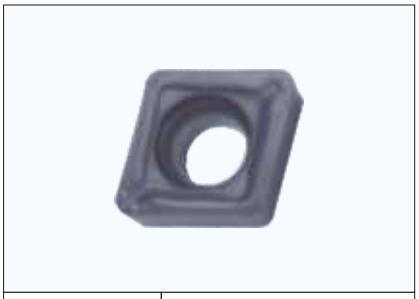
NF groove insert series, good versatility, stable life, paired with a variety of brands, widely used in a variety of materials round cars drilling and boring.



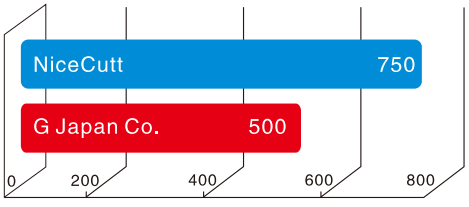




Case 1



Workpiece material	S45CVS
Machining parts	The outer circle facing
Insert	CCMT09T308–NF/NS4125

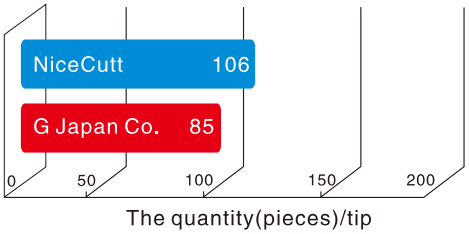


The cutting parameters
Vc=110m/min
f=0.2mm/r
ap=2mm

Cutting life
+50%

Case 2

Workpiece material	S45CVS
Machining parts	The inner hole machining
Insert	TCMT16T304–NF/NF4125

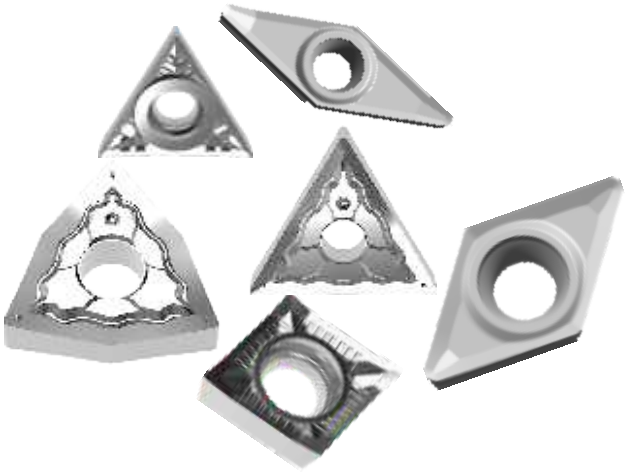


The cutting parameters
Vc=160m/min
f=0.16mm/r
ap=1.5mm

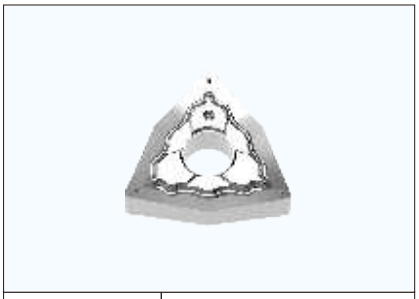
Cutting life
+25%

NL Geometry case study

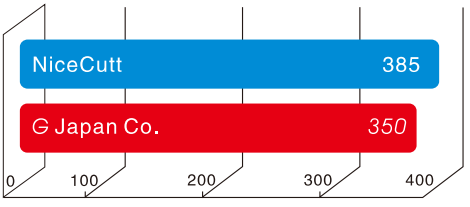
- New polishing process
- The tip is sharpness
- Superior wear resistance
- Chipping stably
- Greatly inhibit the formation o the development humor
- Chipping smoothly
- Very slow cutting resistance,to prevent deformation
- Excellent quality of processing the machine surface
- Adopting new grade of NN9125 and having abrasion resistance and toughness
- Which is open type geometry and the chip flow to the tough surface



Case 1



Workpiece material	A356
Machining parts	Longitudinal and face roughing
Insert	WNGG080408–NL–NN9115

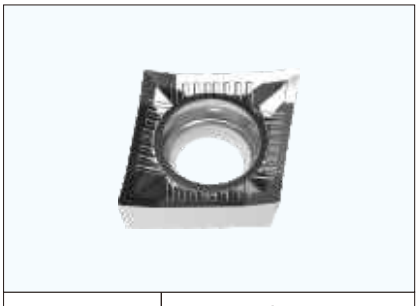


The quantity(pieces)/tip

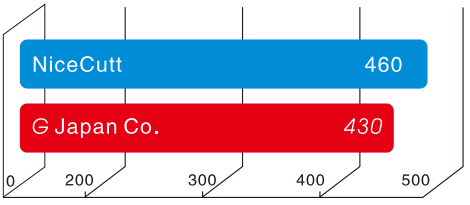
The cutting parameters
Vc=500m/min
f=0.5mm/r
ap=1.5mm

Cutting life
+10%

Case 2



Workpiece material	A356
Machining parts	Internal processing
Insert	CCGT09T304–NL–NN9115



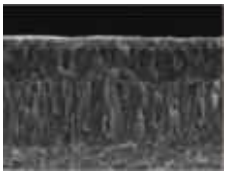
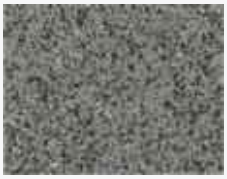
The quantity(pieces)/tip

The cutting parameters
Vc=460m/min
f=0.16mm/r
ap=0.8mm

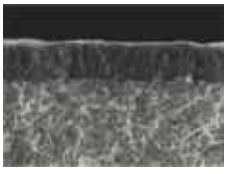
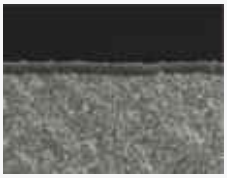
Cutting life
+7%

Turning Insert Grades

1.Grades for P Applications

Grade	Cutting Range	Coating	Advantages
NP1115	Finishing and Semi–finishing		●Super fine MT–TiCN, Al_2O_3 and TiN coating on carbide substrate, smoothsurface and superior wear resistance. ●Application: Suitable for the cuttingof steel and alloy steel in continuous conditions.
NP1125	Semi–finishing to Light Roughing		●Super fine MT–TiCN, Al_2O_3 and TiN coating on graded carbide substrate,smooth surface and superior wear resistance and improved toughness. ●Application: Suitable for the cutting ofsteel and alloy steel in light interrupted
NP1135	Roughing		●Super fine MT–TiCN, Al_2O_3 and TiN coating ongraded carbide substrate, smooth surface and superior fracture resistance. ●Application: Suitable for cutting of steel and alloy steel under interrupted conditions.
NP115T	Finishing and semi–finishing		●Cermet grade with High wear resistanceand good roughness. ●Application:For turning of steel, cast iron and stainless steel in continuous conditions.
NP9125	Semi–finishing and Roughing		●Micro–grain carbide substrate with high hardness and superior wear resistance. ●Application:Suitable forcutting of copper and aluminum alloys in light interrupted conditions.

2.Grades for M–S Applications

Grade	Cutting Range	Coating	Advantages
NM1125	Semi–finishing		●TiCN and TiN coating on good toughness carbide substrate, with good wear resistance,superior adhesion resistance and longer tool life. ●Application: Suitable for stain lesssteel cutting in continuous and light interruptedconditions.
NM3125	Semi–finishing and Roughing		●TiAlN coating on super microg raincarbidesubstrate with superior resistance to thermal shock、mechanical shock and good wear resistance. ●Application:Suitable for stainless steel cuttinginlight interrupted conditions.

Turning Insert Grades

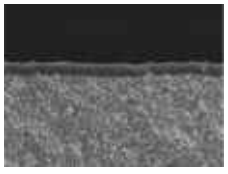
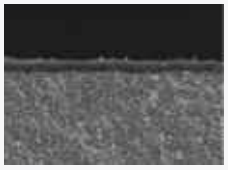
3.Grades for K Applications

Grade	Cutting Range	Coating	Advantages
NK1115	Finishing and Semi–finishing		●MT–TiCN and thick Al_2O_3 coated on micro–grain carbidesubstrate, superior wear resistance.Special post–processingwith smooth coating and smooth coating and shows superior wear resistance and fracture resistance. ●Application: Suitable for nodular iron and gray iron in continuous and light interrupted conditions.
NK1125	Semi–finishing and Roughing		●Thick MT–TiCN+Al2O3 coated on toughness micro–grain carbide substrate,keeping superior wear resistance and greatly improved toughness. ●Application:Suitable for bad machining conditions which require high toughness.

4.Grades for N Applications

NN9115	Semi–finishing and Roughing		●Micro–grain carbide substrate with high hardness and superior wear resistance. ●Application:Suitable forcutting of copper and aluminum alloys in light interrupted conditions.
NPCD9115	Semi–finishing and Roughing		●High density sintered by super fine diamond grains ,have highest wear resistance and fracture resistance,excellent shape edge also

5.Grades for S Applications

NS4115	Semi–finishing to Light Roughing		●Nano–structure AlCrN coating on super micro–grain carbide. ●Application: Suitable for medium milling of P&K materials under dry and wet cutting conditions.
NS4125	Semi–finishing and Roughing		●The new upgrade TiAlN+ coating has excellent heat resistance and oxidation resistance. ●Due to the high adhesion strength to the substrateNS4125 can achieve a reliable tool

6.Grades for H Applications

NCBN9115	Finishing		●Fine grain size, high CBN content and metal binder system. ●High abrasion resistance,outsanding impact strength,strength, excellent edge quality and fine surface

Application Summary of Turning Grades

Workpiece	ISO	Coated		Uncoated	Cermet	PCD	CBN
		CVD	PVD				
P Steel	P10	NP1115, SC4010	NS4115		NP115T		
	P20	NP1125	NS4125		NP115T		
	P30	SC4025	NS4125				
	P40	SC4025					
M Stainless Steel	M10	NM1125	NM3125, NS4125		NP115T		
	M20	NM1125	NM3125, NS4125		NP115T		
	M30	NM1125	NS4125				
	M40						
K Cast Iron	K10	NK1115	NS4115		NP115T		NCBN9115
	K20	NK1115, NK1125	NS4115, NS4125		NP115T		NCBN9115
	K30	NK1125	NS4125				
	K40						
N Non-ferrous Metal	N10			NN9115		NPCD9115	
	N20			NN9115		NPCD9115	
	N30						
	N40						
S Heat-resistant Alloy,TiAlloy	S10		NS4115				
	S20		NS4115, NS4125				
	S30		NS4125				
	S40						
H High Hardness Materials	H10			NN9115			NCBN9115
	H20			NN9115			NCBN9115
	H30						
	H40						

Workpiece Material Table

	ISO Material Group	Workpiece Material	Carbon Content	Tensile Strength N/mm2	Brinell Hardness HB	Rockwell Hardness HRC
P Steel	P1	Low–carbon Steels,Long Chipping.	C<0.25%	<530	<125	
	P2	Low–carbon Steels,Short Chipping, Free–cutting Steels.	C<0.25%	<530	<125	
	P3	High–carbon Steels,Medium–carbon Steels.	C<0.25%	<530	<220	<25
	P4	Alloy Steels,Tool Steels.	C<0.25%	600–850	<330	<35
	P5	Alloy Steels,Tool Steels.	C<0.25%	850–1400	340–450	35–48
	P6	Ferritic Stainless Steels,Martensitic Stainless Steels,PH Stainless Steels.	C=(0–0.4)%	600–900	<330	<35
	P7	High–strength Ferritic Stainless Steels, Martensitic Stainless Steels,PHStainless Steels	C=(0.1–0.6)%	900–1350	330–450	35–48
M Stainless Steel	M1	Austenitic Stainless Steels.	C=(0.05–0.15)%	<600	130–200	
	M2	High–strength Austenitic Stainless Steels and Cast Stainless Steels.	C=(0.05–0.15)%	600–800	150–230	<25
	M3	Duplex Stainless Steels.	C=(0.05–0.20)%	<800	135–275	<30
K Cast Iron	K1	Grey Cast Iron.		125–500	120–290	<32
	K2	Moderately Difficult Alloy Cast iron, Nodular Cast Iron.		<600	130–260	<28
	K3	Difficult High–alloy Cast Iron, Nodular Cast Iron.		>600	180–350	<43
N Non–ferrous Metal	N1	Wrought Aluminium Alloys.		<520	60–90	
	N2	Cast Aluminium Alloys.	Si≤12%	<350	70–100	
	N3	Cast Aluminium Alloys.	Si>12%	200–320	60–120	
	N4	Copper,Copper Alloys.		200–650	60–200	
	N5	Graphite,CFK,CFRP Graphite,Composite Materials.		600–1500		
	N6	GFK,CFK Aluminium–based Composite Materials.		<700	<210	
S Heat–resistant Alloy,TiAlloy	S1	Iron–based Heat–resistant Alloys.		500–1200	160–260	25–48
	S2	Cobalt–based Heat–resistant Alloys.		1000–1450	250–450	25–48
	S3	Nickel–based Heat–resistant Alloys.		600–1700	160–450	<48
	S4	Titanium and Titanium Alloys.		900–1600	300–400	33–48
H High Hardness Materials	H1	Hardened STeels.				45–55
	H2	Hardened STeels.				55–60
	H3	Hardened STeels.				60–65
	H4	Hardened Steels.				>65

Cutting Speed Recommendation Table

Workpiece Material		Cutting Speed (Vc=m/min)		Feed Rate (f=mm/rev)		Cutting Depth (ap=mm)	
		NP9115	NP1115/NP1225	NP9115	NP1115/NP1225	NP9115	NP1115/NP1225
P Steel	Low–carbon Steels	180–300	150–250	0.1–0.6	0.1–0.8	0.5–3.0	1.0–5.0
	Medium–carbon Steels	150–250	120–200	0.1–0.5	0.1–0.6	0.5–2	1.0–5.0
	Alloy Steels	120–200	100–180	0.1–0.4	0.1–0.5	0.5–1.5	1.0–4.0
	tools Steels	100–180	80–160	0.1–0.4	0.1–0.5	0.5–1.5	1.0–4.0

Workpiece Material		Cutting Speed (Vc=m/min)		Feed Rate (f=mm/rev)		Cutting Depth (ap=mm)	
		NM1125/NM3125	NS4115/NS4125	NM1125/NM3125	NS4115/NS4125	NM1125/NM3125	NS4115/NS4125
M Stainless Steel	Austenitic	150–250	150–250	0.1–0.5	0.1–0.5	0.5–3.5	0.5–3.5
	High–Strength Austenitic	120–200	120–200	0.1–0.4	0.1–0.4	0.5–3.0	0.5–3.0
	Cast Stainless Steels	100–180	100–180	0.1–0.35	0.1–0.35	0.5–2.0	0.5–2.0
	Duplex Stainless Steels.	80–160	80–160	0.1–0.35	0.1–0.35	0.5–2.0	0.5–2.0

Workpiece Material		Cutting Speed (Vc=m/min)		Feed Rate (f=mm/rev)		Cutting Depth (ap=mm)	
		NK1115/NK1125	NS4115/NS4125	NK1115/NK1125	NS4115/NS4125	NK1115/NK1125	NS4115/NS4125
K Cast Iron	Grey Cast Iron	200–350	180–300	0.1–0.5	0.1–0.5	1.0–5.0	1.0–5.0
	Alloy Cast Iron,	200–400	150–250	0.1–0.4	0.1–0.4	1.0–5.0	1.0–5.0
	Nodular Cast Iron.	120–250	120–200	0.1–0.35	0.1–0.35	1.0–4.0	1.0–4.0

Workpiece Material		Cutting Speed (Vc=m/min)		Feed Rate (f=mm/rev)		Cutting Depth (ap=mm)	
		NN9115	NPCD115	NN9115	NPCD115	NN9115	NPCD115
N Non–ferrous Metal	Wrought Aluminium	400–800	600–1800	0.05–0.25	0.05–0.30	0.5–3.0	0.5–3.0
	Cast Aluminium	300–600	500–1600	0.05–0.25	0.05–0.30	0.5–3.0	0.5–3.0
	Copper,Copper	200–400	200–600	0.05–0.25	0.05–0.30	0.5–3.0	0.5–3.0
	composite Materials	400–800	400–1200	0.05–0.25	0.05–0.30	0.5–3.0	0.5–3.0

Workpiece Material		Cutting Speed (Vc=m/min)		Feed Rate (f=mm/rev)		Cutting Depth (ap=mm)	
		NS4115	NS4125	NS4115	NS4125	NS4115	NS4125
S Heat–resistant Alloy,TiAlloy	Iron–based Alloys	40–100	40–100	0.05–0.2	0.05–0.2	0.5–3.5	0.5–3.5
	Cobalt–based Alloys	40–100	40–100	0.05–0.2	0.05–0.2	0.5–3.0	0.5–3.0
	Nickel–based Alloys	40–100	40–100	0.05–0.2	0.05–0.2	0.5–2.0	0.5–2.0
	Titanium Alloys	40–100	40–100	0.05–0.2	0.05–0.2	0.5–2.0	0.5–2.0

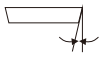
Workpiece Material		Cutting Speed (Vc=m/min)	Feed Rate (f=mm/rev)	Cutting Depth (ap=mm)
		NCBN115	NCBN115	NCBN115
H High Hardness Materials	Hardened HRC45–55	120–250	0.05–0.20	0.3–1.0
	Hardened HRC55–60	120–250	0.05–0.20	0.3–1.0
	Hardened HRC60–65	120–250	0.05–0.20	0.3–1.0

ISO Turning Indexable Inserts Identification System

Symbol	Shape	ComerAngle	Figrure
H	Hexagon	120°	
O	Octagon	135°	
P	Pentagon	108°	
S	Square	90°	
T	Triangle	60°	
C	Rhombic	80°	
D		55°	
E		75°	
F		50°	
M		86°	
V		35°	
W	Trigon	80°	
L	Rectangle	90°	
A	Parellelogram	85°	
B		82°	
K		55°	
R	Round	—	

①Shape Symbol

Symbol	Relief Angle
A	3°
B	5°
C	7°
D	15°
E	20°
F	25°
G	30°
N	0°
P	11°
O	Other



②Relief Angle Symbol

Symbol	Tolerace(mm)			Tolerance(inch)		
	Corner Height(m)	Thickness(S)	I.C.Size(ød)	Corner Height(m)	Thickness(S)	I.C.Size(ød)
A	±0.005	±0.025	±0.025	±0.0002	±0.001	±0.001
F	±0.005	±0.025	±0.013	±0.0002	±0.001	±0.0005
C	±0.013	±0.025	±0.025	±0.0005	±0.001	±0.001
H	±0.013	±0.025	±0.013	±0.0005	±0.001	±0.0005
E	±0.025	±0.025	±0.025	±0.001	±0.001	±0.001
G	±0.025	±0.013	±0.025	±0.001	±0.005	±0.001
J	±0.005	±0.025	±0.05~±0.13	±0.0002	±0.001	±0.002~±0.005
K	±0.013	±0.025	±0.05~±0.13	±0.0005	±0.001	±0.002~±0.005
L	±0.025	±0.025	±0.05~±0.13	±0.001	±0.001	±0.002~±0.005
M	±0.08~±0.18	±0.013	±0.05~±0.13	±0.003~±0.007	±0.005	±0.002~±0.005
N	±0.08~±0.18	±0.025	±0.05~±0.13	±0.003~±0.007	±0.001	±0.002~±0.005
U	±0.13~±0.38	±0.013	±0.08~±0.25	±0.005~±0.015	±0.005	±0.003~±0.01

③Relief Angle Symbol

①	②	③	④	⑤
T	N	M	G	22

④Chipbreaker/Hole Symbol

Symbol	Hole	Hole Shape	Chipbreaker	Shape
N	Without	—	Without	
R			Single-sided	
F			Double-sided	
A	With	With Hole	Without	
M			Single-sided	
G			Double-sided	
W		With hole and one countersink 40° ~60°	Without	
T			Single-sided	
Q		With hole and two countersink 40° ~60°	Without	
U			Double-sided	
B		With hole and one countersink 70° ~90°	Without	
H			Single-sided	
C		With hole and two countersink 70° ~90°	Without	
J			Double-sided	
X	—	—	—	

⑤Cutting Edge Length Symbol(ISO)(mm)

P1		S		C		W		T		D		V		K		I.C.Size (mm)
Symbol	Length	Symbol	Length	Symbol	Length	Symbol	Length	Symbol	Length	Symbol	Length	Symbol	Length	Symbol	Length	
		03	3.97	03	4.0			06	6.9	4	4.8					3.97
		04	4.76	04	4.8			08	8.2	5	5.8					4.76
05	5	--	—	—	—	—	—	—	—	—	—	—	—	—	—	5
		05	5.56	05	5.6	03	3.8	09	9.6	6	6.8					5.56
06	6	--	—	—	—	—	—	—	—	—	—	—	—	—	—	6
		06	6.35	06	6.5	04	4.3	11	11	7	7.8	11	11.2			6.35
		07	7.94	08	8.1	05	5.4	13	13.8	9	9.7					7.94
08	8	--	—	—	—	—	—	—	—	—	—	—	—	—	—	8
09	9.525	09	9.525	09	9.7	06	6.5	16	16.5	11	11.6	16	16.6	16	19.7	9.525
10	10	--	—	—	—	—	—	—	—	—	—	—	—	—	—	10
12	12	--	—	—	—	—	—	—	—	—	—	—	—	—	—	12
12	12.7	12	12.7	12	12.9	08	8.7	22	22	15	15.5	22	22.1			12.7
15	15.875	15	15.875	16	16.1	10	10.9	27	27.5	19	19.4					15.875
16	16	--	—	—	—	—	—	—	—	—	—	—	—	—	—	16
19	19.05	19	19.05	19	19.3	13	13	33	33	23	23.3					19.05
20	20	--	—	—	—	—	—	—	—	—	—	—	—	—	—	20
		22	22.225	22	22.6			38	38.5	27	27.1					22.225
25	25	--	—	—	—	—	—	—	—	—	—	—	—	—	—	25
25	25.4	25	25.4	25	25.8			44	44	31	31					25.4
31	31.75	31	31.75	32	32.2			55	55	38	38.8					31.75
31	32	--	—	—	—	—	—	—	—	—	—	—	—	—	—	32

Insert Shape:H.O.P.S.T.C.E.M.W.R									
I.C.Size (mm)	Tolerance of I.C.Size(ød)(mm)		Tolerance of Corner Height(m)(mm)		I.C.Size (inch)	Tolerance of I.C.Size(ød)(mm)		Tolerance of Corner Height(m)(mm)	
	ClassJ.K.L.M.N	ClassU	ClassM.N	ClassU		ClassJ.K.L.M.N	ClassU	ClassJ.K.L.M.N	ClassU
6.35	±0.05	±0.08	±0.08	±0.13	0.250	±0.002	±0.003	±0.003	±0.005
9.525					0.375				
12.7	±0.08	±0.13	±0.13	±0.2	0.500	±0.003	±0.005	±0.005	±0.008
15.875	±0.1	±0.18	±0.15	±0.27	0.625	±0.004	±0.007	±0.006	±0.011
19.05					0.750				
25.4	±0.13	±0.25	±0.18	±0.38	1.000	±0.005	±0.010	±0.007	±0.015
31.75	±0.15	±0.25	±0.2	±0.38	1.250	±0.006	±0.010	±0.008	±0.015
32					1.260				

Insert Shape:D					
Inscribed Circle Size		Tolerance of I.C.Size		Tolerance of Corner Height	
mm	in	mm	in	mm	in
6.35	0.250	±0.05	±0.002	±0.11	±0.004
9.525	0.375	±0.05	±0.002	±0.11	±0.004
12.7	0.500	±0.08	±0.003	±0.15	±0.006
15.875	0.625	±0.10	±0.004	±0.18	±0.007
19.05	0.750	±0.10	±0.004	±0.18	±0.007

Insert Shape:V					
Inscribed Circle Size		Tolerance of I.C.Size		Tolerance of Corner Height	
mm	in	mm	in	mm	in
6.35	0.250	±0.05	±0.002	±0.15	±0.006
9.525	0.375	±0.05	±0.002	±0.15	±0.006
12.7	0.500	±0.08	±0.003	±0.20	±0.008
15.875	0.625	±0.10	±0.004	±0.27	±0.011
19.05	0.750	±0.10	±0.004	±0.27	±0.011

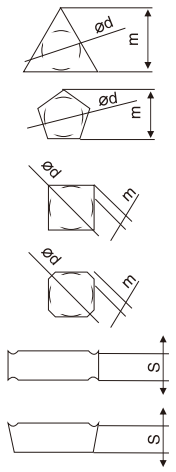
Symbol	Thickness(mm)
01	1.59
02	2.38
T2	2.78
03	3.18
T3	3.97
04	4.76
05	5.56
06	6.35
07	7.94
09	9.52
Thickness Symbol	

⑥ ⑦ ⑧

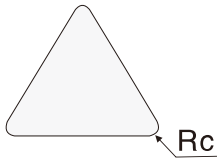
04 08 – NM2

⑥ ⑦ ⑧

Inscribed Circle Size
Thickness(s)
Corner Height(m)



Corner Symbol



Symbol	Corner–Rc(mm)
00	0.03
02	0.2
04	0.4
08	0.8
12	1.2
16	1.6
20	2.0
24	2.4
28	2.8
32	3.2

Chipbreaker Symbol
Indicates the cutting properties and chipbreaker

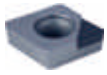
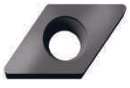
Features of Turning Inserts （Negative)

Geometry	80° Rhombic	55° Rhombic	90° Square	60° Triangle	35° Rhombic	80° Trigon
BF Finishing for P M S						
NFM Semi–Finishing for P M S						
NM Medium cutting for P						
NGM Medium cutting for P						
NR Rough cutting for P						
NL Semi–finish for P M S						
None Rough cutting for K						
NK1 Medium cutting for K						
NK2 Rough cutting for K						
New NPL Light cutting for P						
New NG Medium cutting for P						
New NX Medium cutting for P						
New NH Rough cutting for P						
New NA Rough cutting for P						
R/L–S Finish cutting for P M						
R/L Semi–finish for P M						

Features of Turning Inserts (Negative)

Geometry Features	80° Rhombic	55° Rhombic	90° Square	60° Triangle	35° Rhombic	80° Trigon
NCBN Hardened HRC45–65						
NL General cutting for N						

Features of Turning Inserts (Positive)

Geometry Features	80° Rhombic	55° Rhombic	90° Square	60° Triangle	35° Rhombic	80° Trigon
L/R–F Finishing for P M S						
NF Finishing for P M S						
NM Medium cutting for P						
NFS Finishing for P M S						
NL General cutting for N						
NCBN Hardened HRC45–65						
NPCD General cutting for						
None Rough cutting for K						
KNUX Rough cutting for P						